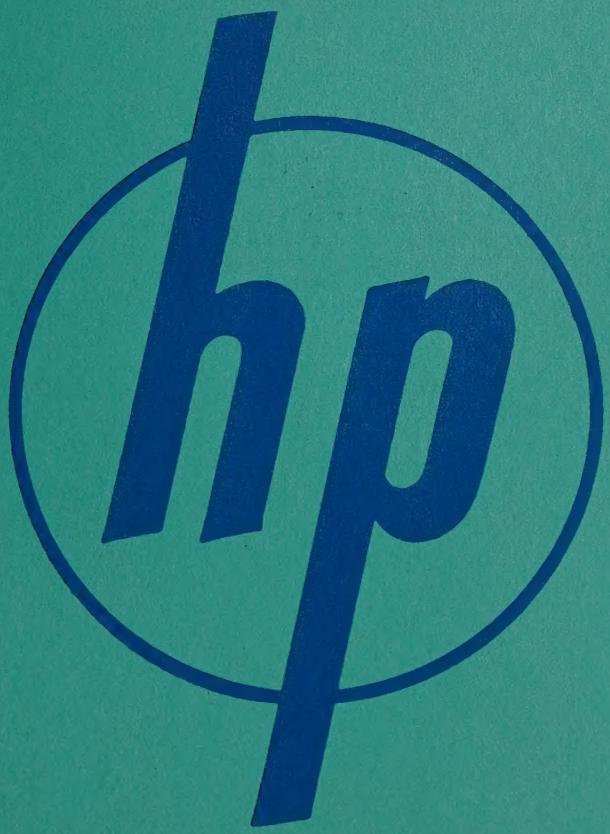
596-3A

MODEL 382A

PRECISION WAVEGUIDE ATTENUATOR



HEWLETT-PACKARD COMPANY
395 Page Mill Road • Palo Alto, California, U.S.A.

INSTRUCTION AND OPERATING MANUAL

FOR

596-3A

MODEL 382A

PRECISION WAVEGUIDE
ATTENUATOR

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HEWLETT-PACKARD COMPANY
395 PAGE MILL ROAD, PALO ALTO, CALIFORNIA, U.S.A.

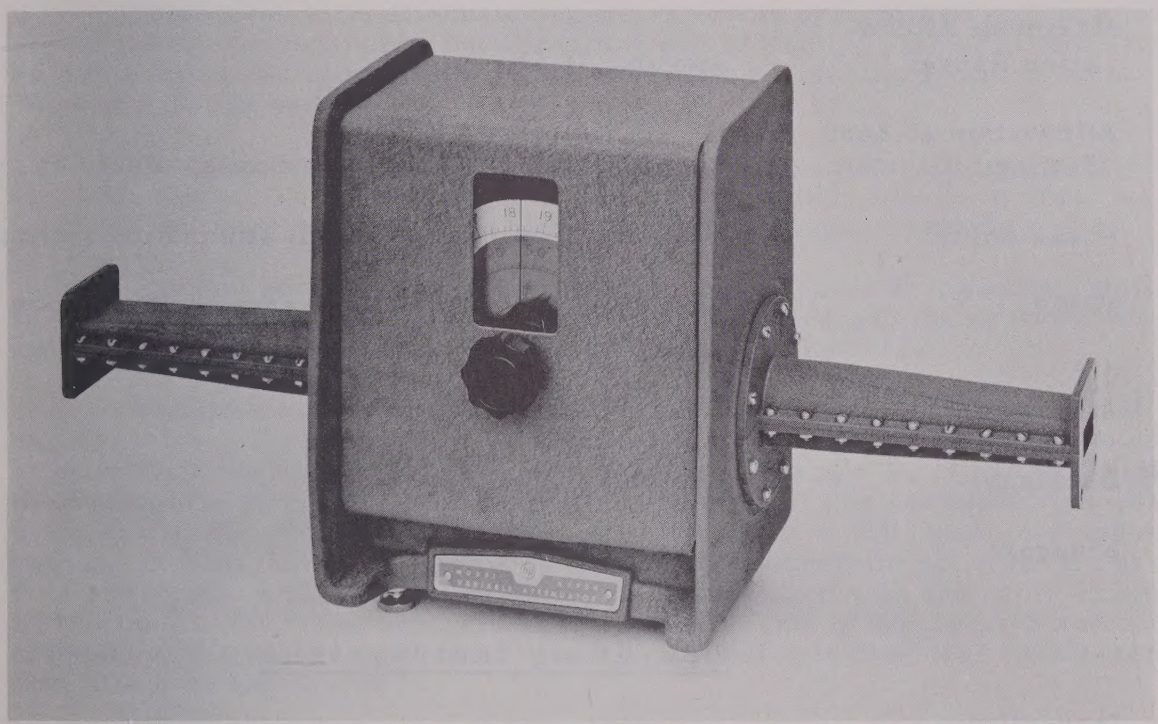
INSTRUCTIONS

MODEL 382A

PRECISION WAVEGUIDE ATTENUATOR

General Description

The Model 382A variable attenuator series is designed for use in waveguide systems, and range in frequency coverage from 5850 to 18,000 Mc/s. They provide from zero to 50 db attenuation at any frequency within their individual working range. Attenuation is read directly on the dial. Fixed loss (insertion loss at zero setting) is less than one db over the frequency range. Standing wave ratio is low and variation of phase with setting is practically negligible.



Specifications

Model:	J382A	H382A	X382A	P382A
Frequency Range, KMC:	5.3 - 8.2	7.0 - 10.0	8.2 - 12.4	12.4 - 18.0
Waveguide Size:	1-1/2" x 3/4"	1-1/4" x 5/8"	1" x 1/2"	0.702" x 0.391"

	J382A	H382A	X382A	P382A
Power-handling capacity, watts, average, continuous duty:	10	10	10	5
Size, Length:	25"	19-7/8"	16"	12-1/8"
Height:	8"	8"	8"	7-3/4"
Depth:	6-1/4"	6-1/4"	4-1/2"	4-1/2"
Weight, Net:	12	10	5	5
Shipping:	32	30	19	18

Calibrated Attenuation Range: 0 - 50 db.

Maximum Attenuation Range: Approx. 70 db.

Attenuation at Zero Setting: Less than 1 db. Calibration data available on request.

Phase Shift: Variation less than 1^{o} for all attenuation settings.

VSWR: Less than 1.15 over entire range of attenuation and frequency.

Accuracy: ±2% of the reading in db.

Backlash: Less than 0.3 db at 50 db.

Flanges: Cover type.

Operating Instructions

Inspection --

This instrument has been thoroughly tested and inspected before being shipped and is ready for use when received.

After the instrument is unpacked, it should be inspected for damage received in transit. If any shipping damage is found, follow the procedure outlined in the "Claim for Damage in Shipment" page at the back of the instruction book.

Operation --

Standard cover flanges are provided at the ends of the Model 382A for connection into the waveguide system. Leveling feet are provided to carry the weight of the instrument and prevent strain on one flange when the other is unsupported. They should be carefully adjusted so that the flanges mate properly. When the instrument is supported at both ends, as in permanent setups, the feet may be removed altogether if desired.

Attenuation is set and read directly on the dial. For precise settings the bottom edge of the dial is exposed so that it may be "thumbed". The MAX. setting gives maximum attenuation -- approximately 70 db at all frequencies.

Principle of Operation --

The Model 382A attenuator operates on the principle of splitting the signal into two components and absorbing one of them. This is accomplished by using three resistive films, two fixed in the end sections, one mounted in a rotatable center section.

The films are made by evaporating resistive material onto mica sheets two mils thick. These are clamped between waveguide halves in order to center them and to make electrical contact between films and waveguide walls.

The end sections consist of rectangular-to-round transitions, with the films fixed at right angles to the E-field. The center section is round waveguide with choke joints at the ends to allow it to be rotated.

When the center film is in line with the end films, all three are at right angles to the E-field and the signal passes through with substantially no attenuation. When the center film is rotated through an angle Θ, however, it absorbs the component of the signal parallel to it, $E \sin \Theta$. The perpendicular component, $E \cos \Theta$, oriented at the angle Θ with respect to the input, arrives at the output end film, where the same splitting into components occurs. $E \cos \Theta \sin \Theta$ is absorbed, while $E \cos^2 \Theta$ emerges at the output with the same orientation as the input. Since the attenuation is a function only of the angle Θ and not of frequency, the dial is calibrated directly according to the ideal cosine-squared law: $DB = 40 \log \cos \Theta$.

The input end film is necessary primarily to make the instrument bilateral. However, it also serves to absorb reflected energy and to reduce the errors due to internal reflections.

Because of the principle of operation of the Model 382A, phase shift through it is, ideally, completely independent of setting. This has been confirmed experimentally to about 40 db. Below this level it is not readily feasible to check the phase shift. However, because of the finite attenuation of the center film, some phase shift variation undoubtably sets in before maximum attenuation is reached.

The principle sources of error in the Model 382A are internal reflections and finite attenuation in the center film. Reflections are minimized by tapers on the films and careful design of the transitions and choke joints. The center film attenuation is made as great as possible consistent with low reflections and reasonable length and is approximately 70 db. Since this attenuation does vary with frequency, it is not possible to calibrate the instrument all the way to 90° rotation. A margin of about 20 db is necessary to maintain accuracy, so that calibration is carried to 50 db. The cosine-squared law of operation gives a very non-linear scale, which is offset to some extent by making it spiral on the dial.

Maintenance

No maintenance is required on the Model 382A other than occasional lubrication of bearing surfaces. The worm and worm gear, ball bearings, dog washers, flag shaft, and the ends of the center section should be lubricated whenever necessary with a light grease such as Lubriplate #105V made by Fiske Brothers, Refining Co., Newark, New Jersey and Toledo, Ohio.

These are all sufficiently accessible upon removal of the cover. Do not adjust the spring loading on the drive shaft, as this may affect the calibration.

CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. Include model number, type number and serial number when referring to this instrument for any reason.

WARRANTY

Hewlett-Packard Company warrants each instrument manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replace any defective parts thereof (except tubes, fuses and batteries). This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and which upon our examination is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

If any fault develops, the following steps should be taken:

1. Notify us, giving full details of the difficulty, and include the model number, type number and serial number. On receipt of this information, we will give you service instruction or shipping data.

2. On receipt of shipping instruction, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins provided the instrument is not covered by the warranty.

SHIPPING

All shipments of Hewlett-Packard instruments should be made via Railway Express. The instruments should be packed in a wooden box and surrounded by two to three inches of excelsior or similar shock-absorbing material.

DO NOT HESITATE TO CALL ON US

HEWLETT-PACKARD COMPANY
Laboratory Instruments for Speed and Accuracy
395 PAGE MILL ROAD PALO ALTO, CALIFORNIA

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